

ASSEMBLY
and
OPERATING
MANUAL

for



P A C O

BATTERY ELIMINATOR KIT
Special Low-Ripple Output
Model B-10

P A C O ELECTRONICS CO., INC.

A DIVISION OF ***PRECISION*** APPARATUS CO., INC.

70-31 84th STREET, GLENDALE 27, L. I., N. Y.



SPECIFICATIONS

CONTINUOUSLY VARIABLE OUTPUT VOLTAGE 0-8 volts d-c, 0-16 volts d-c

STANDARD OUTPUT CURRENT CAPACITY:

6V Range 10 amps d-c, continuous
20 amps d-c, intermittent

12V Range. 6 amps d-c, continuous
12 amps d-c, intermittent

SPECIAL (LOW RIPPLE) OUTPUT:

6V and 12V 5 amps d-c maximum (0.3% maximum ripple at this special terminal)

POWER REQUIREMENTS 117 volts, 60 cps. AC only, 150 watts maximum

GENERAL CONSTRUCTION INFORMATION

INTRODUCTION

The PACO kit you have just purchased is a high quality instrument and when assembled and used in accordance with the instructions in this manual, will provide many years of trouble-free service. Therefore the first, and we feel, most valuable advice we can offer in this manual is that you work carefully and patiently. By so doing, you will experience more satisfaction in your new instrument, and greater confidence in your ability.

THE MANUAL

We suggest that you spend a little time NOW and read this entire manual thoroughly before starting the actual construction of the kit. This will familiarize you with the contents and the general procedure to be followed.

The step-by-step instructions will help you assemble the instrument with a minimum possibility of error. Further assistance may be gained by using the large folded diagrams supplied with this manual. These are enlargements of the smaller-size figures referred to in the step-by-step instructions. They should be attached to the wall above your work bench for greater ease in reference.

We advise you to keep this manual after the kit has been constructed for future assistance in the use and maintenance of your PACO instrument.

UNPACKING

We cannot stress too strongly the need for exercising care throughout these instructions. This is especially true now as you unpack the kit. Parts may easily become lost or damaged through carelessness at this point. Do not throw away any packing materials until all parts are accounted for. Each part should be checked against the parts list at the back of the manual in order to make certain all parts are present and are correct as to value and type. The color code chart at the back of this manual will assist you in identifying doubtful parts. Please notify us promptly if any shortage or erroneous part is discovered. Return the inspection slip with your letter in order to expedite the handling. Keep in mind however, that minor differences in some parts do not indicate an error. A .05 MFD capacitor for example, may sometimes be found in the kit where a .047 MFD is called for in the parts list. Such substitutions are checked carefully before they are made, and you may be assured they will work satisfactorily. Should you find a screw, nut or lockwasher missing, it can be readily obtained at your local hardware store. The registration card which accompanies each PACO kit, **MUST** be filled in and returned to the company immediately after purchase. Our warranty applies only to registered instruments.

TOOLS REQUIRED FOR ASSEMBLY AND WIRING OF PACO KITS

Only standard type tools are required in the construction of PACO kits. A good quality soldering iron with a small tip (50 or 60 watts); a pair of 6" long-nosed pliers; a pair of 5" or 6" diagonal or side-cutting pliers; small end wrenches or a small adjustable wrench. Screwdriver-handle nut-drivers may be used in place of wrenches in most cases.

ASSEMBLY AND WIRING

The position of wires and parts in this instrument is critical in some cases, and changes may affect the operation. Follow the diagrams closely and you should encounter little if any difficulty. The layout has been thoroughly prechecked and tested for best results.

When wiring, remove only about 1/4 inch of insulation from the ends of hook-up wire. Excessive removal of insulation may result in the exposed wire shorting to nearby terminals or wiring. If the wire has a brown, baked enamel coating (transformer leads for example) be sure to scrape the enamel off, with sandpaper or a knife, to expose the copper wire before making a terminal connection. Leads on parts (resistors, capacitors, etc.) should be trimmed to proper length before mounting. Use spaghetti (insulated sleeving supplied in this kit) over bare leads that could possibly short to other wiring or terminals. Do not cut leads too short. All parts should fit between the designated points without strain. If it is difficult to determine the color of the transformer leads, carefully scrape off some wax from the leads.

SOLDERING

We wish to emphasize at this point the extreme importance of proper soldering technique. Much engineering skill and effort has gone into making your PACO instrument capable of high quality performance. In order for you to fully realize these capabilities, good solder joints are essential. If you have had little or no previous experience in soldering, we suggest you spend some time practicing with an old tube socket and some scraps of wire before doing any soldering on your kit.

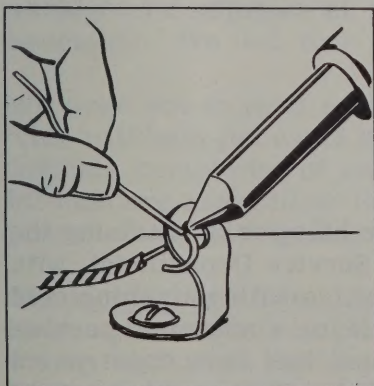
Only good quality television and radio type solder with a non-corrosive rosin core should be used: **THIS IS IMPORTANT. ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE ANY PACO INSTRUMENT IN WHICH ACID CORE SOLDER OR PASTE FLUX HAS BEEN USED.**

To remove any doubt about your solder, we suggest you make certain the roll you buy has been clearly labeled for television and radio use.

Prior to soldering, be sure terminals and leads are clean and free of wax or corrosion. Make a good mechanical connection by crimping the leads on the terminals with your pliers. Do not rely on solder alone for mechanical strength.

Keep the tip of your iron properly tinned in accordance with the instructions of the soldering iron manufacturer. It should have a "bright" appearance and be free from excess solder. An old rag can be used to wipe the hot tip clean.

When using your iron, avoid applying excessive heat as this could cause damage to insulation or parts. It could also result in a flux flooding condition which could cause a leakage path between adjacent terminals of switches and tube sockets. **ON THE OTHER HAND, INSUFFICIENT HEAT WILL OFTEN RESULT IN A "COLD" OR HIGH RESISTANCE SOLDER CONNECTION. THIS USUALLY HAS A DULL AND "GRAINY" APPEARANCE.** A good solder joint will present a smooth and "shiny" appearance.



Proper technique to obtain good results involves applying the iron to the joint, holding it there momentarily until the joint heats, and then applying solder to joint and iron simultaneously. Apply the iron long enough to cause solder to flow smoothly into the joint. Do not simply melt drops of solder on the joint....Solder must **FLOW** into the joint to be effective.

THE PACO WARRANTY

PACO Electronics Co., Inc., hereafter referred to as the Company, guarantees all parts supplied with any PACO kit to be free of defects in material and workmanship under normal use and service for a period of ninety (90) days from the date of purchase. The Company's obligation under this warranty is limited to those parts which are returned transportation prepaid, with prior permission of the Company, and in the judgement of the Company are defective under the terms of this warranty. This warranty is in lieu of all other warranties, and the Company neither assumes, nor authorizes any other person to assume for them, any other liability in connection with the sale of PACO kits.

We urge the assembler to follow the instructions provided in this manual. The Company assumes no responsibility for any damages or injuries sustained in the assembly or operation of PACO instruments.

All prices and specifications are subject to change without notice. The Company reserves the right to discontinue instruments and to alter specifications at any time without incurring any obligation to incorporate new features in PACO instruments previously sold.

The registration card, which accompanies each PACO kit, **MUST** be filled in and returned to the Company immediately after purchase. This warranty applies only to registered instruments.

INFORMATION REGARDING THE PACO WARRANTY

All material and parts supplied with PACO kits have been carefully selected to meet design requirements and should perform their functions satisfactorily. However, on occasion, improper instrument operation may be traced to a faulty tube or component. Should replacement of a part be necessary, write directly to PACO Electronics Co., Inc., and supply the following information:

- 1) Identify the model and serial number of the kit in which the part is used. The model number is printed on the front panel of the instrument. The serial number will be found affixed to the back of the instrument case.
- 2) Identify the questionable part thoroughly. Use the part number and description as given in the parts list.
- 3) Describe in detail the nature of the defect, or your reason for requesting a replacement.

Please do not return the part in question until you receive notice from us to do so. Do not tamper with the component as this will void our warranty.

When returning tubes, pack them carefully to avoid breakage in shipment. Broken tubes will not be replaced in any instance. Parts that have been broken or damaged through carelessness, misuse, or improper construction on the part of the kit builder will not be eligible for replacement.

SERVICE POLICY

PACO Electronics Co., Inc., offers its full cooperation and assistance to help you in obtaining the specified performance from your instrument. We maintain a complete Service Department with which you may correspond in the event you experience operational difficulties with your completed instrument. We will inspect and repair this B-10 Battery Eliminator kit for a minimum service charge of \$4.00 plus the cost of necessary parts, provided this instrument has been constructed and completed in accordance with the instructions given in this manual. This special repair

service is available for a period of one year from the date of purchase. Repair service for PACO instruments that have been in use longer, will be available for PACO owners at reasonable cost.

Instruments not entirely completed or which have been modified in design, will not be accepted for repair. Instruments which show evidence of the use of acid core solder or paste fluxes will be returned not repaired.

Instruments for repair or service **MUST** be returned to us, transportation charges **PREPAID**, in accordance with the following shipping instructions.

SHIPPING INSTRUCTIONS

When returning a PACO instrument for repair or service, be sure that all parts are securely mounted. Always pack carefully in a rugged, oversized container, preferably wood, using a generous supply of padding such as excelsior, shredded paper, or crumpled newspaper. Do not ship in the original kit carton, as this carton is not considered adequate for safe shipment of the completed instrument. Attach a tag to the instrument giving your name, address, and trouble experienced. Never return an instrument unless it is accompanied by a full explanation of difficulties encountered. The more explicit the details, the more rapidly your instrument can be handled and processed.

Please ship Via Railway Express **PREPAID** and address to:

PACO ELECTRONICS CO., INC.
70-31 84th STREET
GLENDALE 27, L.I., N.Y.

ATTENTION: SERVICE DIVISION

A **FRAGILE** label should appear on at least four sides of the carton. After repair, the return shipment will be by Railway Express **COLLECT**, including repair-service charges unless otherwise requested by previous correspondence.

Please take note that a carrier cannot be held liable for damage in transit if, in **HIS OPINION**, packing is insufficient.

STEP-BY-STEP ASSEMBLY

These instructions were prepared by skilled technicians and technical writers from experience gained through actual construction of this PACO kit. Therefore, you will find them arranged in as logical a sequence as possible with every consideration given to the practical aspects of kit assembly. We feel that they are the fastest and best method for assembling your PACO kit.

We urge you to read each step thoroughly, and understand it completely before performing it. This will help you avoid errors. We also suggest that you use the check space (✓), provided to indicate completion of each step. This will help to prevent omissions in the assembly. Many kit builders also follow the practice of crossing out, with a colored pencil, each wire and component on the wiring diagram after installation.

The (Solder) and (Don't Solder) designations in the instructions are self-explanatory and should be complied with throughout assembly. When you see (Don't Solder) after a step, you should only crimp the lead to the terminal, and proceed to the next step. A later step will indicate when all leads have been connected to this terminal, and soldering is to be done.

All parts, after being checked against the parts list, should be placed where they are readily available and will not be lost or damaged. You may find it advantageous to group parts and place them in suitable containers.

To aid you in the placement of components, a system of alphabetical and numerical coding has been set up. Certain components such as switches and controls, have been coded with letter designations relating to the function of the component. For example, the designation "C" indicates a control, and the designation "S" indicates a switch. In kits having more than one of this type of component, distinction between them is made by adding a second letter to the first in alphabetical sequence. For example, the designation SA indicates one switch, and the designation SB indicates a second switch, etc.

Other components such as tube sockets and terminal strips, have been assigned single letter designations having no particular reference to function. These designations are usually assigned in the order in which the component is installed, and will not always be the same in other kits. For example, the letter "A" may indicate a tube socket in one kit and perhaps a terminal strip or other component in another kit.

Numbers have been assigned to terminals on the various components. Thus a designation such as SA2 indicates terminal 2 of switch "SA"; SB3 indicates terminal 3 of switch "SB", etc.

You are now ready to proceed with the construction of your PACO B-10 Battery Eliminator and Charger.

ASSEMBLY PROCEDURE

- (1) 1. Mount the three binding posts to the front panel at D (Figure 3) as shown in Figure 1, using flat fibre and shoulder washers, #8 solder lugs and #8 nuts.
- (2) 2. Mount the double-pole double-throw (DPDT) toggle switch (6 terminals) to the front panel at SA (Fig. 3) (also see Fig. 2).

NOTE

The switch is mounted to the front panel by two nuts (see Fig. 2) - a front-of-panel knurled circular nut and a rear-of-panel hexagonal nut. Before mounting the switch to the panel, thread the hexagonal nut flush up against the body of the switch. Insert the switch from the rear of the panel so that the toggle projects from the front of the panel with the toggle arm in a vertical position (the toggle moves up and down). Thread the knurled circular nut on the switch until the nut is flush with the threaded portion of the switch. Then tighten the rear hexagonal nut until it presses against the front panel, securing the switch to the panel.

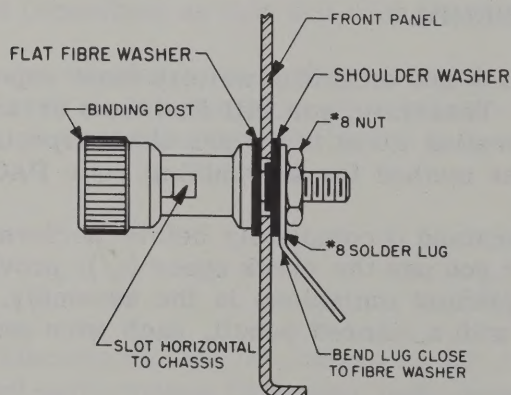


Figure 1

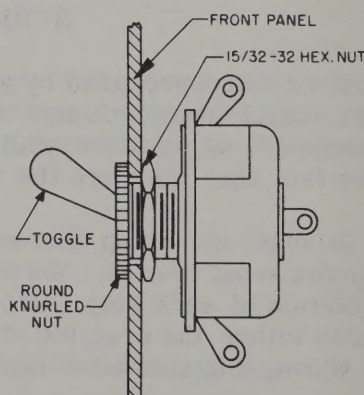


Figure 2

- (3) 3. Mount the fuseholder to the front panel at J (Fig. 3), as shown in Figure 4, using a 1/2" rubber washer, 1/2" lockwasher, and 1/2-24 nut.

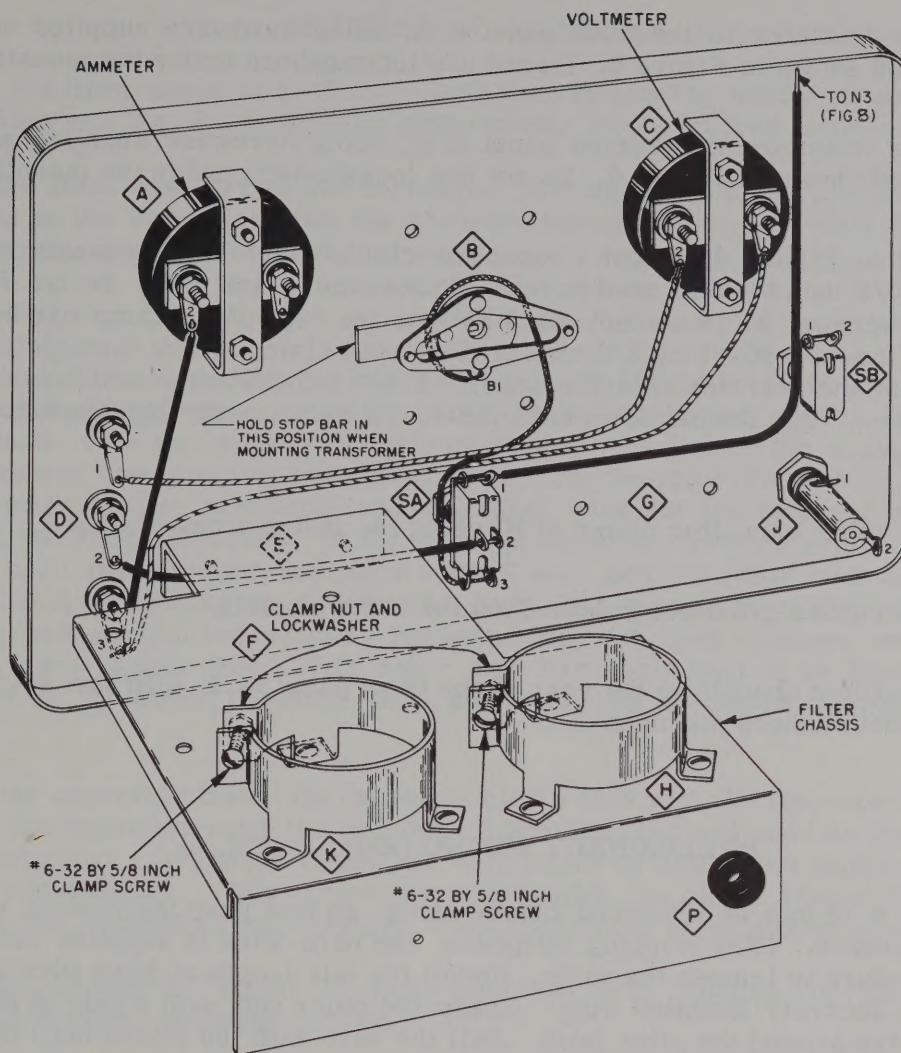


Figure 3

- (4) 4. Mount the single-pole-single-throw (SPST) toggle switch to the front panel at SB (Fig. 3) with the lugs positioned as illustrated in Figure 3. Mount the switch flush with the front panel as described in step 2.
- (5) 5. Mount the transformer rotor to the front panel at B (Fig. 3) as illustrated in Figure 5, using control lockwasher, bakelite control washer, and control nut. The control lockwasher goes between the rotor and the rear of the front panel.

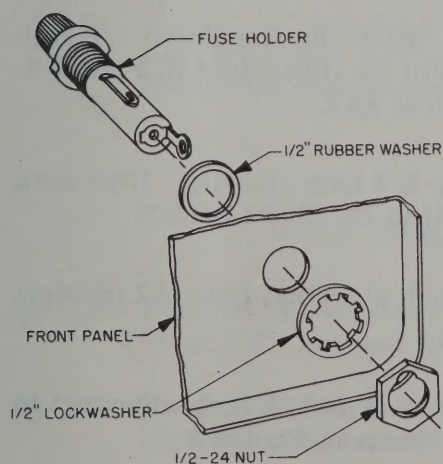


Figure 4

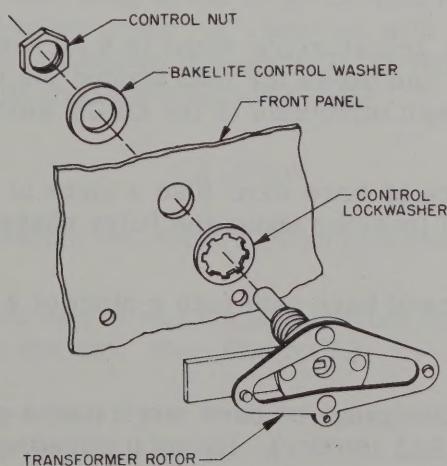


Figure 5

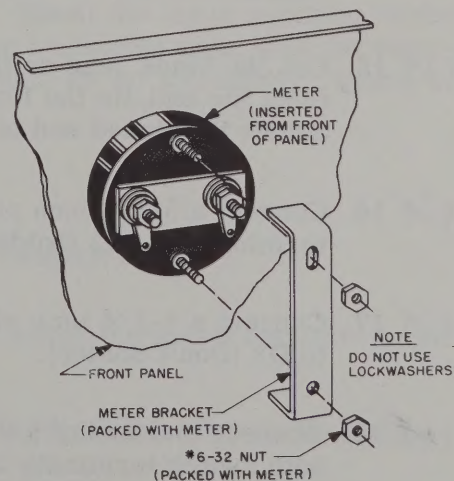


Figure 6

- (✓) 6. Mount the ammeter to the front panel at A, using hardware supplied with the meter. Use method shown in Figure 6. Do not use lockwashers under the mounting nuts.
- (✓) 7. Mount the voltmeter to the front panel at C, using hardware supplied with the meter. Use method shown in Figure 6. Do not use lockwashers under the mounting nuts.
- (✓) 8. Referring to Figure 3, mount a capacitor clamp to the filter chassis at H with three #6-32 by 3/8 inch binding head screws, lockwashers and nuts. Do not fully tighten the mounting screws; allow enough slack so that the capacitor clamp can be moved easily by hand. Insert a #6-32 by 5/8 inch binding head clamp screw through the two clamping ears, from the rear towards the panel. Place a lockwasher and nut on the end of the clamp screw. Run the nut down until the screw projects through the nut. Do not tighten any further.
- () 9. Mount the other capacitor clamp at K, using the instructions of step 8.
- () 10. Insert the rubber grommet in hole P on the filter chassis.
- () 11. Mount the filter chassis to the rear of the front panel at E with two #6-32 binding head screws, lockwashers and nuts.

PRELIMINARY WIRING (Refer to Fig. 3)

The 14 gauge bare wire can be tempered before using, so that your instrument will have a neat professional appearance. (For shipping purposes, the bare wire is supplied untempered.) Use the following procedure to temper the wire: Uncoil the full length of bare wire as supplied, and place one end in a securely mounted vise. Grasp the other end with a pair of pliers, and wind several turns of wire around the plier jaws. Pull the wire with the pliers until the full length of wire stretches several inches. You will note that the wire is much stiffer now, which is normal in the tempered condition. Do not re-coil the wire; keep it straight and cut off lengths as needed.

- (✓) 12. Connect a 9-1/2 inch piece of red hook-up wire from C2 (Solder) to D1 (Don't Solder).
- (✓) 13. Connect a 10-1/2 inch piece of red hook-up wire from C1 (Solder) to D3 (Don't Solder).
- (✓) 14. Strip the insulation 1/4 inch from one end of the black stranded hook-up wire. Tin the lead and connect it to the transformer rotor at B1 (Solder).
- (✓) 15. Cut the black lead on the transformer rotor to 8 inches. Strip the insulation 5/8 inch from the end, tin the lead and dress the lead around the rotor as illustrated in Figure 3. Solder the tinned end to both terminals of the DPDT switch at SA3.
- (✓) 16. Connect a 5-1/4 inch piece of bare wire (use a piece of 4-3/4 inch sleeving) from both terminals at SA2 (Solder) (passing under the filter chassis) to D2 (Don't Solder).
- (✓) 17. Connect a 4-1/4 inch piece of bare wire (use a piece of 4 inch sleeving) from A2 (Solder) to D3 (Don't Solder).
- (✓) 18. Connect one end of a 9 inch piece of bare wire (use a piece of 8-1/2 inch sleeving) to both switch terminals at SA1 (Solder). Dress the lead as shown in Figure 3.

MECHANICAL ASSEMBLY

- (✓) 19. Mount the filter choke at F (Fig. 3) with four #8 binding head screws, lockwashers and nuts (also see Fig. 8). Orient the choke so that the short lead is close to the front panel.
- (✓) 20. With the rotor stop bar in the horizontal position (Fig. 3) so that the flat on the rotor shaft is on the bottom, mount the transformer over the rotor with four #6-32 binding head screws from the front of the panel.

NOTE

Mount the transformer so that the two thin black transformer leads are at the bottom. Be sure that the transformer mounting straps do not pinch any wires. Place a knob on the rotor shaft, with the set-screw bearing against the flat of the shaft. Tighten just enough to prevent the knob from slipping. Now turn the rotor through its full range. If the rotor makes secure pressure-loaded contact with the transformer in all positions, fully tighten the knob set-screw. If the rotor is too loose (rotates with almost no drag), remove the knob, transformer, and rotor control nut. Remove rotor from panel, and place the second control lockwasher against the first. Re-assemble completely. Mount the rotor, using both control lockwashers between rotor and back of panel, being careful not to pinch the rotor pigtail wire. With rotor stop bar positioned as in Figure 3, remount the transformer. Remount the rotor knob, tightening the set-screw against the flat of the rotor shaft.

- (✓) 21. Place the capacitor inside the capacitor clamp at H with the two capacitor terminals up. Rotate the capacitor until the red dot (+) terminal is positioned as far as possible from the front panel. Grasp the clamp nut with a pair of pliers and tighten the clamp screw with a screwdriver. This procedure will tighten the clamp around the capacitor, preventing the capacitor from moving. Then tighten the three mounting screws.
- (✓) 22. Referring to step 21, mount the other capacitor at K. Tighten the clamp screw, and then tighten the three mounting screws.

RECTIFIER SUB-ASSEMBLY

- (✓) 23. Referring to Figure 7, mount the long terminal of the overload switch to the larger rectifier with a #10 lockwasher and nut.
- (✓) 24. Mount a #10 solder lug, pointing up, on the short terminal of the overload switch (shown at L in Fig. 8) with a #10 nut. Also see Figure 7.
- (✓) 25. Remove the nuts from both ends of the large rectifier. Mount the large rectifier to the small "Z" bracket and to the large "Z" bracket with the hexagonal nuts, with the rectifier terminals oriented as shown in Figure 7. If the nuts go on too tightly, a drop of household lubricating oil on the threads will help.

CAUTION

Do not disassemble the rectifiers as this may damage them.

- (✓) 26. Remove the nut from one end of the small rectifier and mount the small rectifier to the large "Z" bracket with the nut. (See Figure 7.)
- (✓) 27. Mount the rectifier sub-assembly to the front panel at G (Figure 3) with two #6-32 binding head screws, lockwashers and nuts.

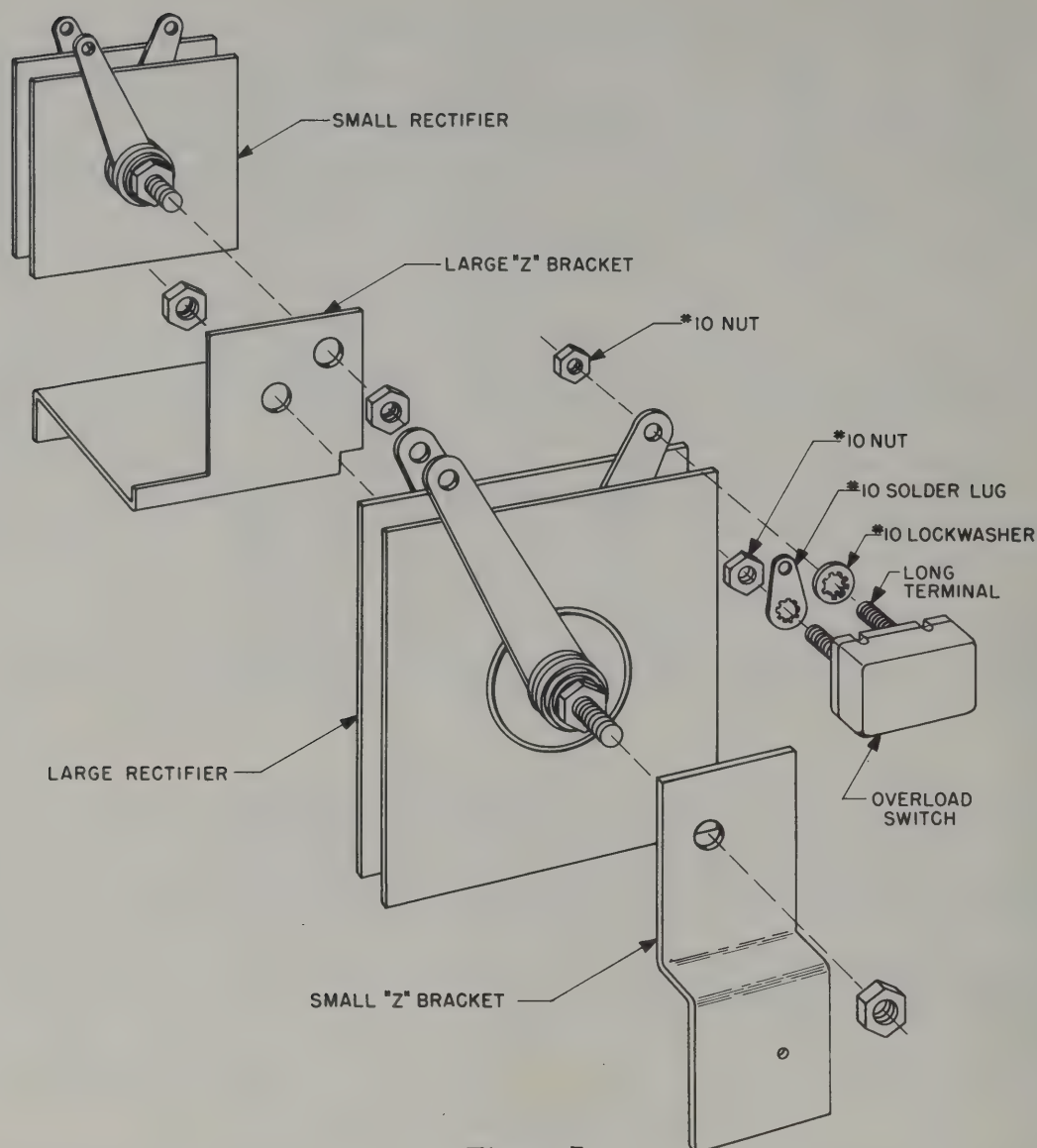


Figure 7

FINAL WIRING (Refer to Figure 8)

- (✓) 28. Connect a 13 inch piece of bare wire (use a 12-1/2 inch piece of sleeving) from D3 (Solder) to K2 (Don't Solder). Dress the lead as shown in Figure 8.
- (✓) 29. Connect a 13 inch piece of bare wire (use a 12-1/2 inch piece of sleeving) from D2 (Solder) to K1 (Don't Solder). Dress the lead as shown in Figure 8.
- (✓) 30. Connect the short lead from the filter choke to D1 (Don't Solder).
- (✓) 31. Connect the other lead from the filter choke to K1 (Solder). See Figure 8.
- (✓) 32. Connect a 11 inch piece of bare wire (use a 10-1/2 inch piece of sleeving) from H1 (Solder) to D1 (Solder). Dress the lead as shown in Figure 8.
- (✓) 33. Connect a 3-1/8 inch piece of bare wire (use a 2-5/8 inch piece of sleeving) from H2 (Solder) to K2 (Solder).
- (✓) 34. Connect one green lead at the top of the transformer to M2 (Don't Solder) of the large rectifier. See Figure 8.

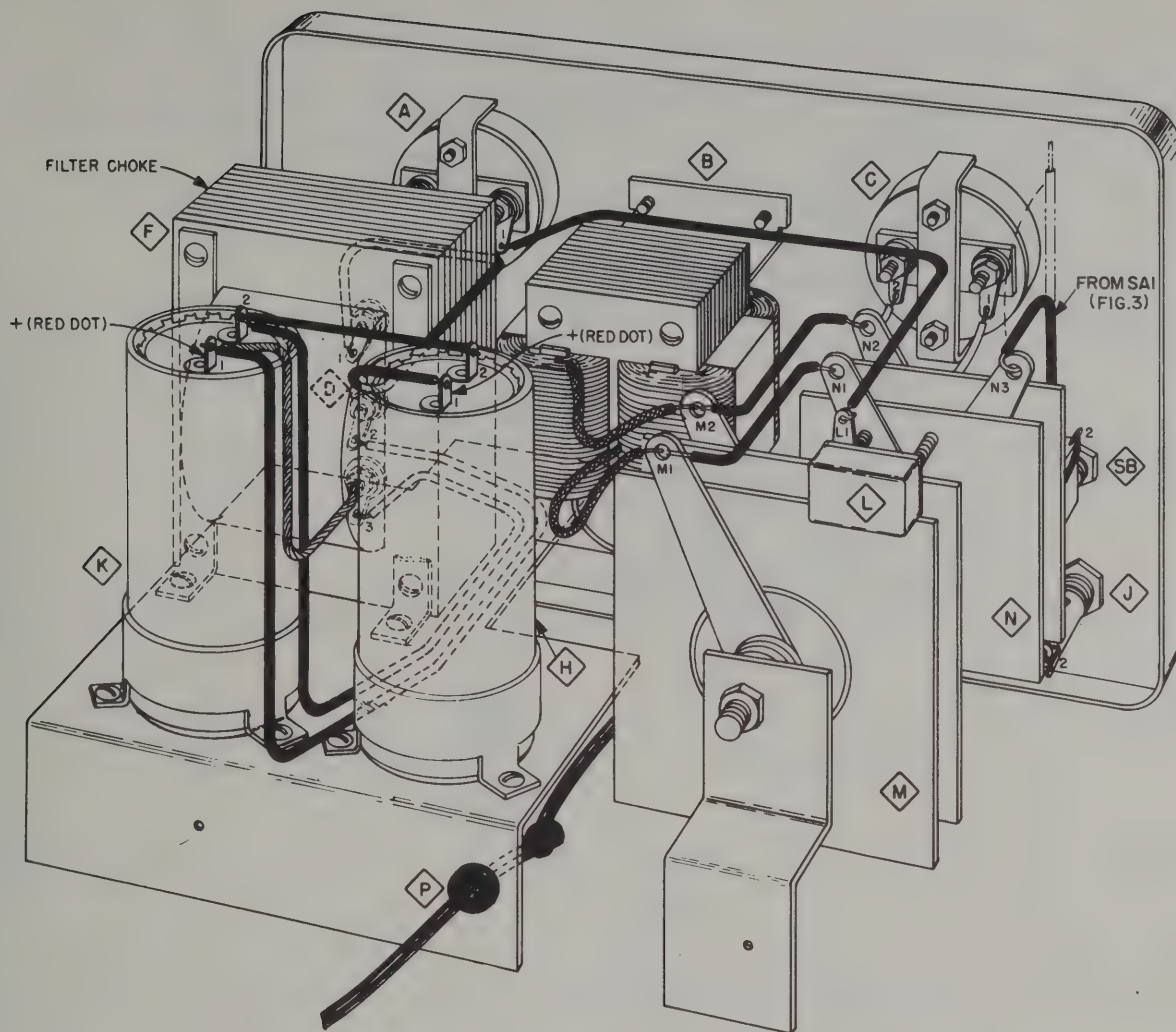
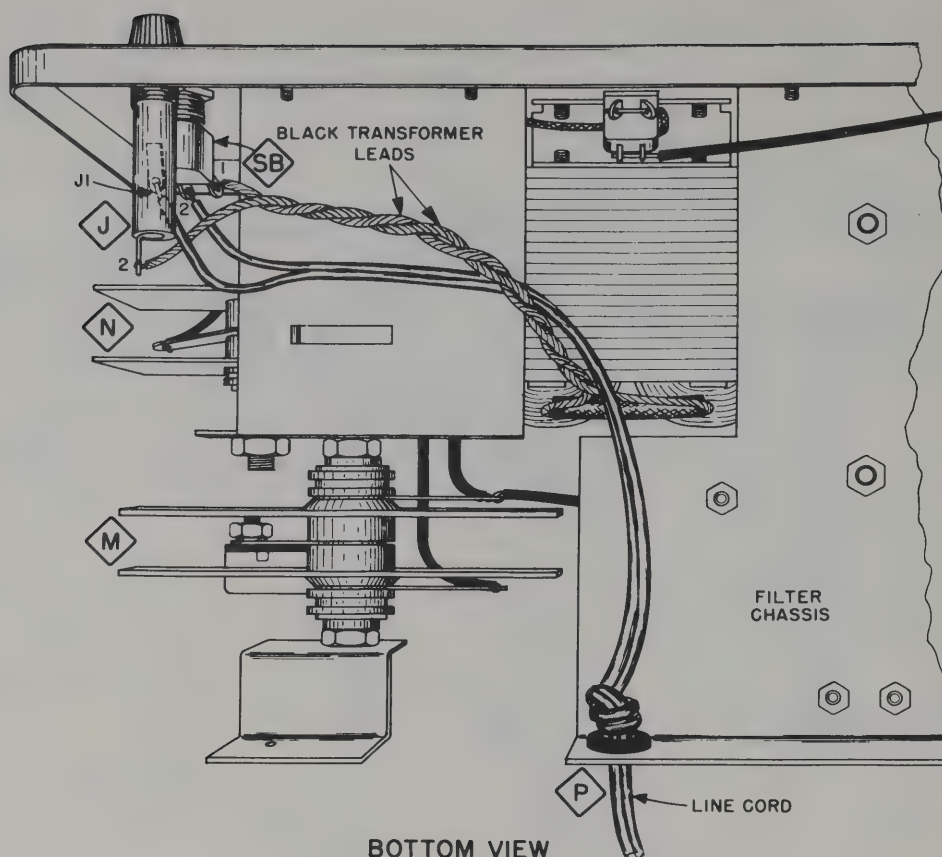


Figure 8

- (✓) 35. Connect the other green lead to M1 (Don't Solder). See Figure 8.
- (✓) 36. Connect a 3-3/4 inch piece of bare wire (use a 3-1/4 inch piece of sleeving) from M2 (Solder) to N2 (Solder). See Figure 8.
- (✓) 37. Connect a 3-3/4 inch piece of bare wire (use a 3-1/4 inch piece of sleeving) from M1 (Solder) to N1 (Solder). See Figure 8.
- (✓) 38. Solder the wire from SA1 (step 18) to N3. See Figure 8.
- (✓) 39. Connect a 10 inch piece of bare wire (use a 9-1/2 inch piece of sleeving) from A1 (Solder) to L1 (Solder). Dress the lead as shown in Figure 8.
- (✓) 40. Turn the unit upside down. See Figure 9. Twist together the two thin black leads at the bottom of the transformer. Connect one lead to SB1 (Solder) and the other to J2 (Solder). See Figure 9.
- (✓) 41. Slip approximately one foot of the line cord through the grommet at P and tie a knot in the line cord 10 inches from the end inside the set. Slit the cord apart approximately 3 inches. Dress the cord as shown in Figure 9 and connect one lead to SB2 (Solder). Connect the other lead to J1 (Solder).



BOTTOM VIEW

Figure 9

- (✓) 42. Unscrew the fuseholder cap, insert the fuse and screw back the cap.
- (✓) 43. Mount the cabinet handle to the cabinet as illustrated in Figure 10. Use a lockwasher and nut on each #6-32 oval-head screw.
- (✓) 44. Mount the four rubber feet to the cabinet as illustrated in Figure 11

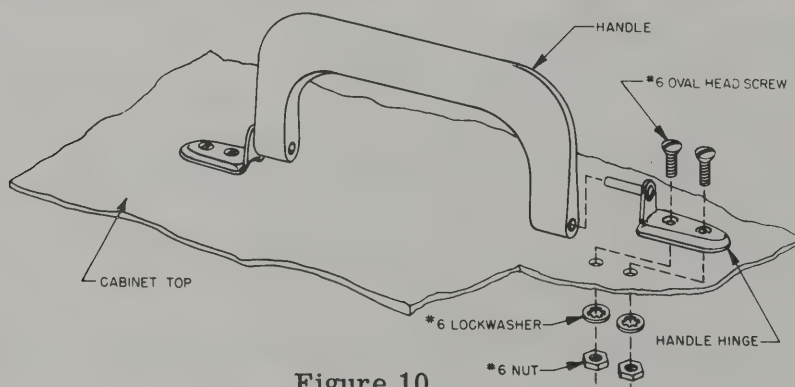


Figure 10

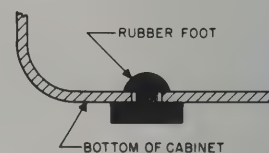


Figure 11

PRELIMINARY CHECKS

- (✓) 45. Perform a careful, complete check of all wiring against the previous instructional steps and Figures 3 and 8.
- (✓) 46. Check each soldered connection for mechanical rigidity as well as for a proper electrical connection. If in doubt, resolder the connection.

WARNING

When performing the following steps, be careful not to touch anything behind the front panel unless the line cord plug is first removed from the supply voltage.

- (✓) 47. Throw LINE ON-OFF switch to OFF, and VOLTAGE CONTROL to 0. Connect the line cord plug to a 117-volt, 50-60 cps. alternating current (a-c) supply.

CAUTION

This unit must be connected to an a-c supply only. Connection to a d-c supply could damage the transformer.

- (✓) 48. Throw the 6V-12V switch to the 6V position.
- (✓) 49. Throw the LINE ON-OFF switch to the ON position and vary the VOLTAGE CONTROL knob, noting the reading on the D.C. VOLTS meter. The meter reading should vary between 0 to 10 volts.

CAUTION

Never change the range selector switch position while the unit is delivering current. Always turn the VOLTAGE CONTROL to 0 or shut the unit OFF, before changing the switch position.

- (✓) 50. Throw the selector switch to the 12V position. Throw the line switch to the ON position and vary the VOLTAGE CONTROL knob. The reading should vary between 0 and 20 volts.

NOTE

With no load, the output voltage can exceed 20 volts. For safety, do not allow the meter reading to exceed 20 volts.

- (✓) 51. If the unit's output voltage varies as described in steps 49 and 50, turn off the unit and pull out the line cord plug. Then, discharge the two filter capacitors by placing a screwdriver blade across the STANDARD OUTPUT binding posts. The voltmeter will return instantly to 0 volts when the capacitors are discharged.

CAUTION

Use a screwdriver with an insulated handle when discharging capacitors.

- (✓) 52. Pass the line cord through the cabinet and through the oval opening in the back. Set the B-10 face down on a clean area on your bench or table and slide the cabinet onto the unit, making sure that the panel lip slides along the outside of the cabinet flange and that the panel is fully seated on the cabinet flange. Fasten the unit into the cabinet with the two #6 sheet metal screws from the back of the cabinet.

This completes the assembly of your PACO Model B-10 Battery Eliminator.

OPERATION PRECAUTIONS

The PACO Battery Eliminator Model B-10 will provide the following outputs, as indicated on the front panel. Do not operate the unit at currents greater than those indicated below as damage to the rectifier units can result.

OUTPUT TERMINALS	CONTINUOUS DUTY	INTERMITTENT DUTY
STANDARD OUTPUT	10 amps at 6 volts 6 amps at 12 volts	20 amps at 6 volts 12 amps at 12 volts
SPECIAL (LOW RIPPLE) OUTPUT	5 amps maximum; 0.3% maximum ripple	5 amps maximum

When connecting any device (such as a car radio, storage battery, etc.) to the output terminals of the PACO B-10, be sure to use a wire size which will be consistent with the current being drawn. A small size wire (small cross section area) will cause an appreciable voltage drop in connecting wires thereby reducing the available voltage at the connected device. When large sized wires are used the voltage drop in the wires will be negligible and can be neglected.

If, during operation, the fuse blows, disconnect the device from the output terminals of the unit and check the device for a short circuit. Never replace the fuse (3 amps at 250 volts) with one of a greater value.

If, during operation, the overload relay switch opens, lower the output voltage with the VOLTAGE CONTROL. The connected device is drawing too much current from the unit, overloading the rectifiers.

OPERATING THE PACO B-10 AS A BATTERY ELIMINATOR

Probably the greatest use for the PACO B-10 will be as a battery eliminator during the servicing of car radios. Since it provides the required voltage and current requirements, it can replace any wet storage battery maintained for this purpose.

Connect the car radio battery leads to the PACO B-10 output terminals; the positive battery car radio lead to a + terminal and the negative battery car radio lead to the - terminal. Since some model cars utilize the chassis of the car as one battery return circuit, it may be necessary to consider the car radio chassis as one lead and connect it to the applicable PACO B-10 output terminal. As an added caution, note that not all chassis battery return circuits are to the negative side of the battery; some cars utilize the chassis for the positive battery return circuit. USE THE STANDARD OUTPUT TERMINALS FOR VIBRATOR-TYPE RADIOS, AND THE SPECIAL OUTPUT TERMINALS FOR TRANSISTOR OR HYBRID TUBE-TRANSISTOR RADIOS.

NOTE

Use a wire size consistent with the current being drawn. Adequate leads can be made from parallel-wire lampcord similar to the B-10 line cord. Obtain two lengths not longer than 4 feet each. Take one length of lamp cord, and strip 3/4 inch of insulation from each end. Twist the two wires of the cord together at each end, and tin with a soldering iron. This length will be one of the leads for connecting the Model B-10 to a load device. Do the same for the remaining length of cord for the other lead.

To operate the unit, proceed as follows:

- a. Throw the LINE toggle switch to the OFF position.
- b. Connect the car radio (or other device) to the desired output terminals (Standard or Special).
- c. Insert the line cord plug into a suitable voltage supply (117 volts, 50-60 cps).
- d. Rotate the VOLTAGE CONTROL to the 0 position (fully counter-clockwise).
- e. Throw the range selector switch to the correct range, 6V or 12V.
- f. Throw the LINE switch to the ON position.
- g. Rotate the VOLTAGE CONTROL clockwise until the D.C. VOLTS meter reads 6.3 volts (for radios operating from 6 volt batteries) or 12.6 volts (for radios operating from 12 volt batteries).

CAUTION

While increasing the output voltage, watch the D.C. AMPERES meter for any excessively high reading. This could indicate a short circuit in the car radio (or other device).

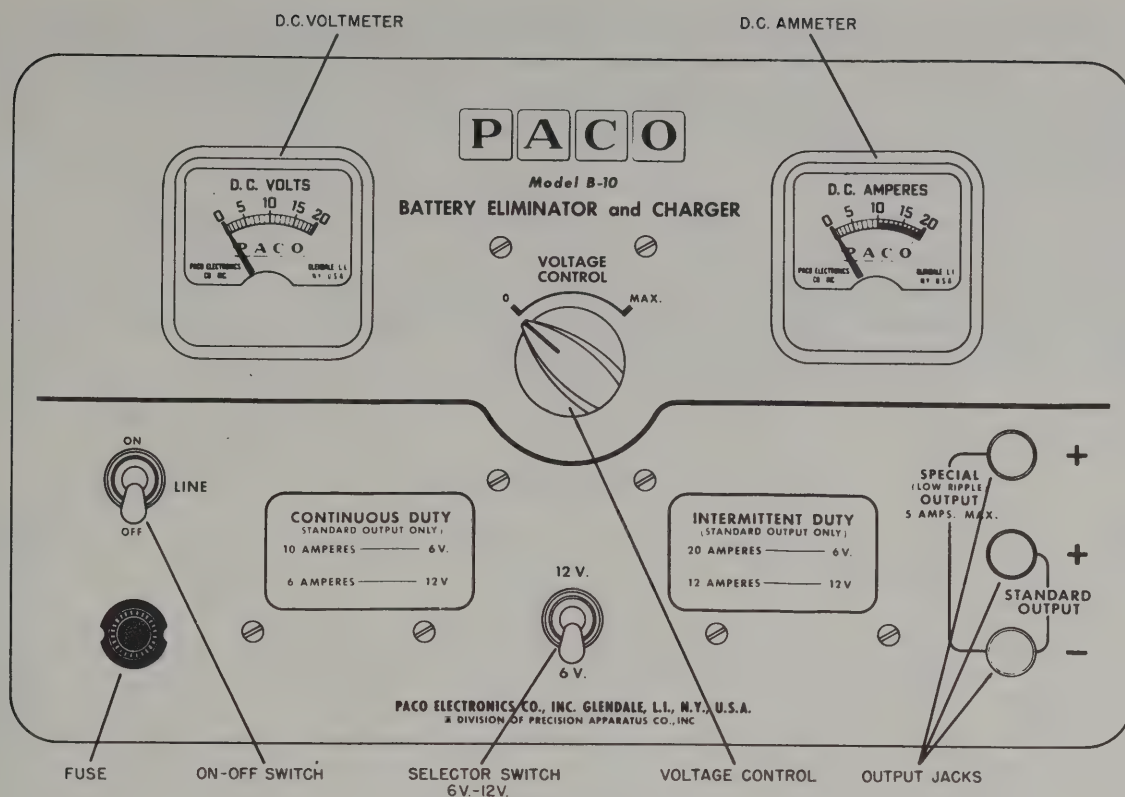


Figure 12

After servicing the 6-volt car radio at its normal operating voltage, check the vibrator operation at 5.2 volts. The vibrator should start at 5.2 volts; however, it might not until some higher value. Vibrators which require as much as 5.6 volts for starting are considered bad and should be replaced as a corrective measure. Vibrators which require between 5.3 to 5.6 volts for starting are questionable and should be replaced as a preventive measure.

CAUTION

This starting voltage test of vibrators is usually accurate. However, occasionally, other components may contribute to the faulty starting operation.

As a further servicing check, raise the operating voltage to 7.8 volts. Operating the car radio at this high value might show up some intermittent trouble.

For 12 volt car radios, double the above voltages. Occasionally, a car radio with push-button or motor tuning may require a very high current to operate its mechanism. In such a case it will probably be necessary to increase the operating voltage accordingly.

OPERATING THE PACO B-10 AS A BATTERY CHARGER

Operating the PACO B-10 as a battery charger is similar to operating it as a battery eliminator. For battery charging, use only the STANDARD OUTPUT terminals. The battery is connected to the STANDARD OUTPUT terminals exactly as the car radio is, positive to + and negative -. As stressed previously, use a large wire size for these connections to reduce the voltage drop in the connecting wires. Battery clips will facilitate connections of the wires to the battery terminals.

The battery to be charged can be removed from the car, or left in it if all car switches, lights, etc., are turned off.

The only test of the state-of-charge of a wet storage battery is the specific gravity of the battery solution. This requires a check of each battery cell with a hydrometer. Before charging the battery, unscrew battery cell caps if so stated by the battery manufacturer. Charge the battery at as slow a rate as time allows; this is best for the battery. A charge rate of 5 amperes is considered a good slow charge.

NOTE

Check the battery cells periodically with the hydrometer until it is determined that the battery is fully charged. Be sure to disconnect the leads from the battery charger and replace the battery cell caps before starting the car.

CIRCUIT DESCRIPTION

Figure 15, at the rear of this booklet, is the complete schematic diagram of the PACO B-10 Battery Eliminator and Charger.

The input voltage is applied to the primary of transformer T1 through the LINE ON-OFF switch S1 and fuse F1. The secondary of the transformer has an adjustable VOLTAGE CONTROL permitting a variation in secondary voltage applied to the rectifiers CR1 and CR2. With range selector switch S2 in the 12V position, the full secondary winding is connected across the rectifiers which are arranged as a full-wave bridge rectifier. During the half AC cycle for which the transformer polarity is that shown in Figure 13, conventional current will flow from the negative side of capacitor C1 through M1, S3, CR2-B, T1 secondary, CR1-A, to the positive side of capacitor C1. During the other half cycle, when the polarity of transformer T1 is reversed, conventional current will flow again from the negative side of C1 through M1, S3, CR2-A, T1 secondary (in the opposite direction), CR1-B, to the positive side of capacitor C1. The significant feature is that, regardless of the instantaneous polarity of transformer T1, the polarity of the currents at capacitor C1 is fixed. This is the characteristic of a direct current, and has been brought about by the switching action of the rectifiers. If no load current is drawn from terminals D2 and D3, capacitor C1 will charge up to a DC voltage equal to the peak AC voltage developed in the transformer secondary. It is to be noted that in an ideal capacitor a direct current will not flow through the capacitor, but will be stored as an electric charge on the electrodes of the capacitor. This charge will manifest itself as a DC voltage existing between the electrodes.

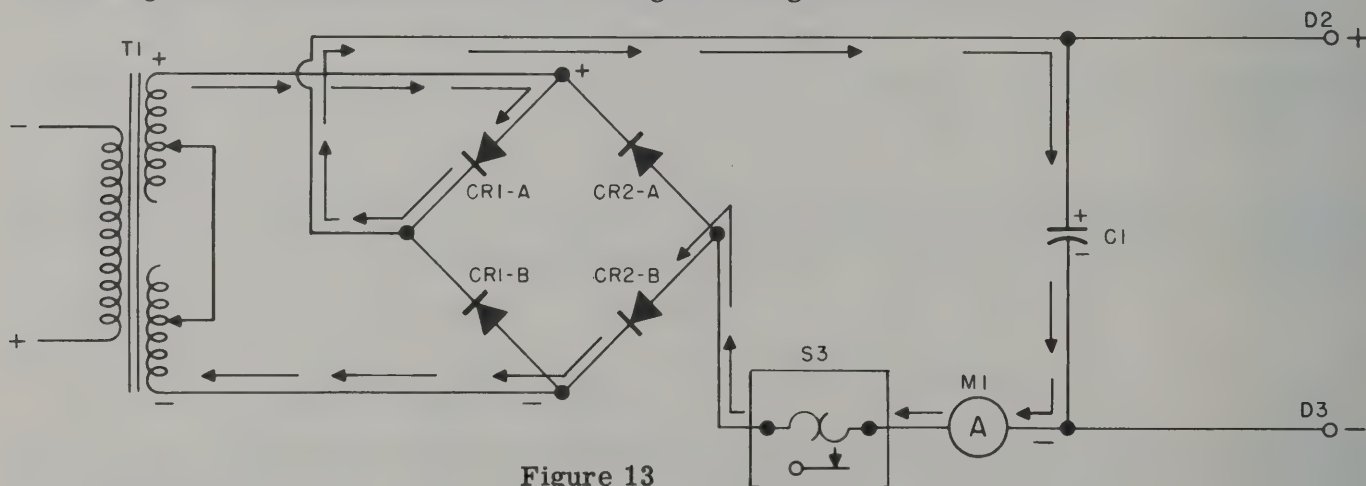


Figure 13

NOTE

In radio and electronic theory, electron flow is from negative to positive. However, in the selenium rectifier field, conventional flow (positive to negative) is still the accepted practice. The arrowheads on the rectifier represent conventional current flow, not electron flow.

With the range selector switch S2 in the 6V position, the transformer is connected across the rectifiers in a full-wave center-tap arrangement as shown in Figure 14.

During the half cycle for which the instantaneous transformer polarity is shown in Figure 14, conventional current flows from the negative side of capacitor C1 through M1, S3, CR2-B, bottom half to center-tap of T1 secondary, to the positive side of C1. During the half cycle when the polarity of the T1 winding is reversed, conventional current again flows from the negative side of C1, through M1 and S3. The current this time returns to the positive side of C1 through CR2-A and the top half to center-tap of T1 secondary. With no load current, C1 charges up to a DC voltage equal to the peak AC voltage across one half of the transformer secondary. Thus, for a given transformer voltage, the DC output voltage of a full-wave center-tapped rectifier arrangement is one half the DC output voltage of a full-wave bridge rectifier arrangement. The RANGE switch, S2, provides for either type of rectification arrangement.

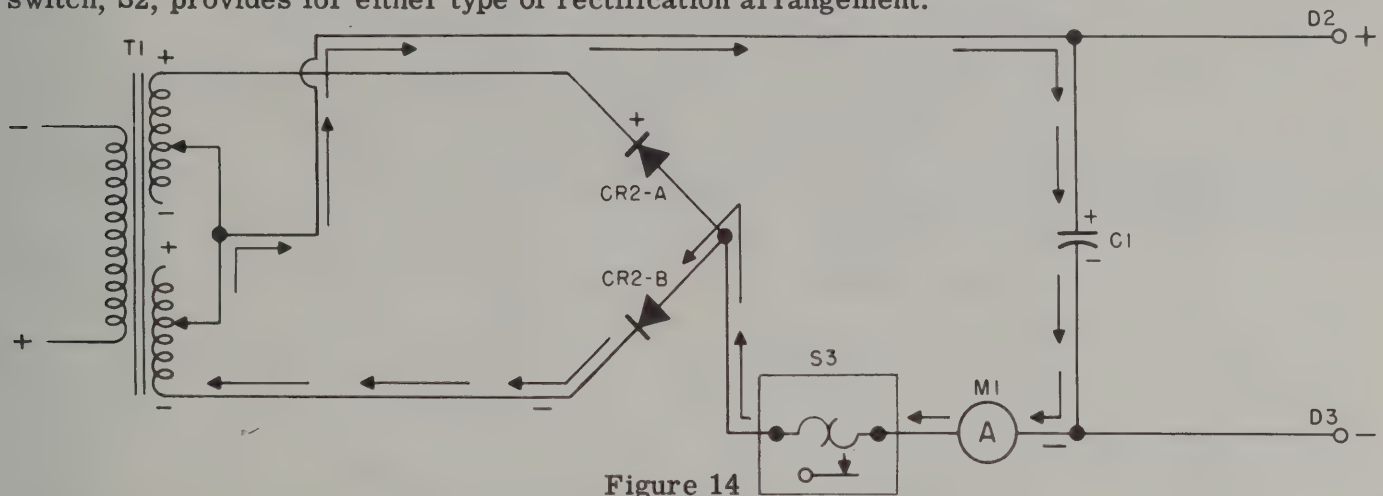


Figure 14

The capacitor C1 acts as a filter to provide a fairly pure d-c output. The "L" filter (L1 and C2) is connected across C1 to provide additional filtering for special purpose low ripple output requirements. This low ripple output is connected across the SPECIAL LOW RIPPLE OUTPUT terminals D1 (+) and D3 (-).

The D.C. VOLTS meter M2 monitors the d-c output voltage, while the D.C. AMPERES meter M1 monitors the d-c output current. The overload switch S3 protects the rectifiers from an overload. It is made of two bi-metallic strips, normally touching each other, providing a direct circuit for the current flow. An overload (excessive current) passing through the switch causes the bi-metallic strips to heat up and separate, breaking the circuit. When the overload is removed, the strips cool and resume their positive contact restoring the full circuit.

TROUBLE-SHOOTING CHART

The following chart should be consulted if any trouble is encountered during the preliminary checks (steps 49 through 51) or during the subsequent normal operation of the unit. If the unit has just been assembled in all probability any incorrect operation is due to incorrect wiring. Check the wiring first.

TROUBLE	POSSIBLE CAUSE	CORRECTIVE ACTION	REFERENCE
1. No output voltage.	a. Line cord plug not inserted.	a. Insert line cord plug.	
	b. Line switch not ON.	b. Throw line switch ON.	
	c. Fuse blown.	c. Replace fuse.	<u>a</u>

TROUBLE	POSSIBLE CAUSE	CORRECTIVE ACTION	REFERENCE
1. No output voltage (cont).	d. Overload relay switch open.	d. Remove device connected to PACO B-10.	<u>b</u>
	e. Transformer burned out.	e. Replace transformer.	<u>c</u>
	f. D.C. AMPERES meter burned out.	f. Replace ammeter.	<u>d</u>
	g. Capacitor shorted.	g. Replace capacitor.	<u>e</u>
	h. Rectifier defective.	h. Replace defective rectifier.	<u>f</u>
	i. D.C. VOLTS meter defective.	i. Replace voltmeter	<u>g</u>
2. Insufficient voltage or current.	a. VOLTAGE CONTROL not set for MAX. value.	a. Reset control.	
	b. Aging rectifiers.	b. Replace defective rectifiers.	<u>f</u>
	c. Defective capacitors.	c. Replace defective capacitors.	<u>e</u>
3. Improper action of range selector switch.	a. Range selector switch defective.	a. Replace switch.	<u>h</u>
4. Improper voltage variation with VOLTAGE CONTROL.	a. Transformer rotor.	a. Replace, or check mounting of transformer rotor.	<u>i</u>
	b. Transformer winding.	b. Replace transformer.	<u>c</u>

TRouble SHOOTING DATA

The following data is provided to facilitate any necessary trouble shooting. All measurements should be made with a Vacuum Tube Voltmeter (VTVM) such as the PACO VTVM Model V-70.

a. Blown Fuse. A blown fuse can be determined by visual or electrical means. Visually, look at the fuse link through the glass. If the link is broken the fuse is blown. In addition, the glass section of a blown fuse usually has a black burned area surrounding the broken link section. Electrically, a resistance check of the fuse will also determine its status; zero resistance indicates a good fuse, infinite resistance a bad fuse.

b. Overload Switch. If the switch is believed defective, remove it from its circuit, let it cool and then measure its resistance. In normal operation the overload switch should read zero resistance.

c. Transformer Data.

	Primary	Secondary
DC Resistance	2 ohms	Less than 0.2 Ω
Voltage	117 V A-C	22 V A-C

NOTES:

1. No load connected to output terminals.
2. VOLTAGE CONTROL at MAX. position.
3. Range selector switch set in 6V position.
4. When measuring winding resistance, have line cord removed from 117 V source, to prevent damaging your ohmmeter. Measure secondary resistance between green leads.

WARNING

Before performing any work on the unit be sure to discharge the two capacitors by placing a screwdriver blade between the STANDARD OUTPUT terminals. However, be sure to use a screwdriver with an insulated handle.

d. Ammeter. The ammeter is a current indicating device, in series with the load. All current drawn from the unit passes through the ammeter. Therefore, an overload (excessive current) could burn out the meter. The ammeter should have less than .01 ohm resistance across its terminals (when disconnected from the remainder of its circuit).

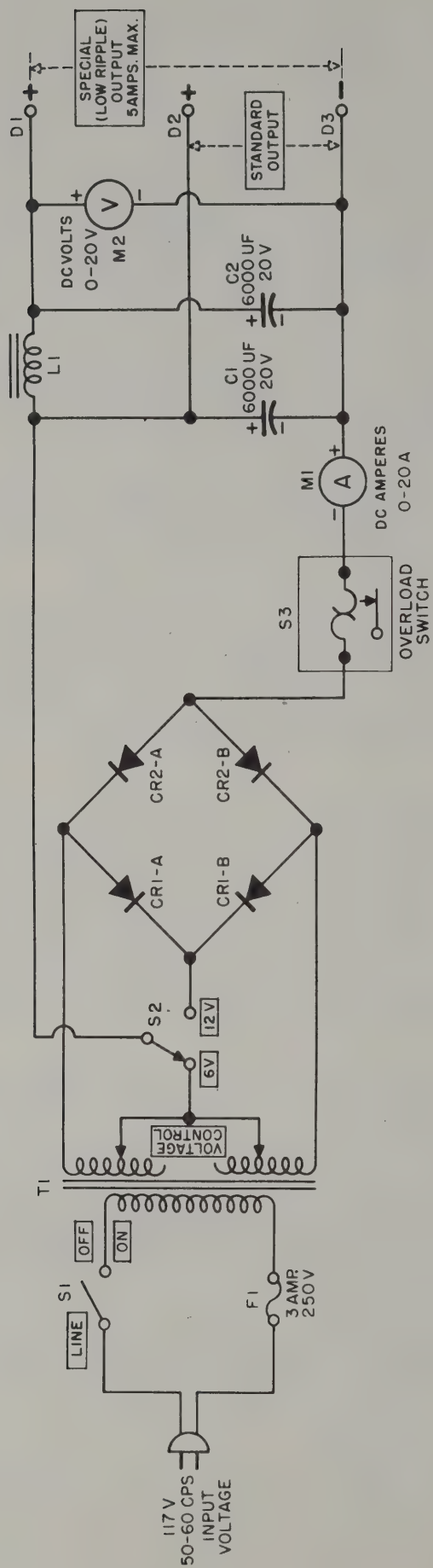
e. Capacitor Test. A capacitor which is suspected of being bad should be checked on a resistance-capacitance checker such as the PACO R-C BRIDGE Model C-20. If such a checker is not available, an alternate check can be conducted with an ohmmeter. With the capacitor disconnected from its circuit, discharge the capacitor and measure its resistance with an ohmmeter. The ohmmeter should read approximately 1,500 ohms or higher. Be sure that the correct ohmmeter polarity is used. In typical ohmmeters the plus terminal is usually negative.

f. Rectifiers. The selenium rectifiers convert a-c to d-c by their ability to pass current in one direction better than another. A measure of their ability is the ratio of forward-to-backward resistance. The resistance across a selenium rectifier depends upon the polarity of the ohmmeter leads; measuring the resistance once and then reversing the leads and measuring again will provide two different readings. The ratio of these two resistance readings is the forward-to-backward resistance of the rectifier. When new, this should be at least 50 to 1; the ratio will vary with the ohmmeter range due to the non-linear characteristics of the rectifier. The greater the ratio the better. During use the selenium rectifier ages, its forward resistance increases and its output decreases. This fact is shown in the ratio number.

g. Voltmeter. The voltmeter is an indicating device similar in construction to the ammeter. The voltmeter should have approximately 500 ohms resistance across its terminals (when disconnected from the remainder of the circuit).

h. Range Selector Switch. The range selector switch is a double-pole, double-throw (DPDT) switch wired as a single-pole, double-throw switch. The center toggle switch terminals are connected internally to those at the two ends depending upon the position of the toggle arm. An ohmmeter connected between the center terminals and those at either end should read zero or infinite resistance depending upon the toggle arm position.

i. Transformer Rotor. The transformer rotor must slide against the transformer windings with positive contact throughout its complete rotation. Refer to steps 5 and 20.



- NOTES
1. INDICATES MARKINGS ON FRONT PANEL.
 2. CR1 - SMALL SELENIUM RECTIFIER.
 3. CR2 - LARGE SELENIUM RECTIFIER.

PACO MODEL B-10 SCHEMATIC

Figure 15

PARTS LIST

PART NO. QTY DESCRIPTION

Capacitors - Transformers - Chokes

P16-214	2	Capacitor, 6000 μ f 20V DC
P18-163	1	Transformer
P18-174	1	Filter choke

Meters - Rectifiers

P12-161	1	Ammeter, 0-20A DC
P12-162	1	Voltmeter, 0-20V DC
P32-117	1	Selenium rectifier, large
P32-118	1	Selenium rectifier, small

Switches - Jacks - Knobs

P14-229	1	Overload switch
P14-151	1	Toggle switch (SPST)
P14-230	1	Toggle switch (DPDT)
P30-105	1	Transformer rotor
P20-124	1	Fuseholder
P20-184	3	Binding post
P10-460	1	Pointer knob

Sheet Metal Parts

P11-280A	1	Filter chassis
P11-281	1	Rectifier mounting bracket, large
P11-282	1	Rectifier mounting bracket, small
P11-285	2	Meter retaining bracket
P22-171	1	Cabinet
P23-242	2	Capacitor clamp
P13-378	1	Panel

Hardware

P24-244	14	6-32 x 3/8" binding head screw
P24-243	4	6-32 x 3/8" oval head screw
P24-245	2	6-32 x 5/8" binding head screw

PART NO. QTY DESCRIPTION

Hardware (cont)

P24-215	2	6 x 3/8" sheet metal screw
P24-267	4	8-32 x 3/8" binding head screw
P24-125	16	6-32 hex nut
P24-116	4	6-32 hex nut (packed with meters)
P24-134	7	8-32 hex nut
P24-138	2	10-32 hex nut
P24-180	1	Control nut
P24-249	2	15/32-32 hex nut
P24-250	2	15/32-32 knurled ring nut
P24-251	1	1/2-24 hex nut
P24-246	16	#6 lockwasher
P24-247	4	#8 lockwasher
P24-248	1	#10 lockwasher
P24-175	2	Control lockwasher
P24-266	1	1/2" lockwasher
P23-224	1	3/8" bakelite washer
P23-245	3	#8 fibre shoulder washer
P23-266	3	#8 flat fibre washer
P23-251	1	1/2" rubber washer for fuseholder
P23-249	3	#8 solder lug
P23-250	1	#10 solder lug

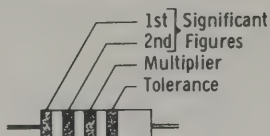
Wire

P21-147-1	1	Line cord
P21-148	1	Length hookup wire
P21-168	1	Length #14 bare wire
P21-169	3	Length insulating sleeving
P21-175	1	Length rotor pig-tail wire

Miscellaneous

P23-243	1	Handle
P23-244	2	Handle hinge
P19-147	1	3A fuse
P29-149	4	Rubber foot
P29-132	1	3/8" rubber grommet
P26-151	1	Instruction manual

COLOR BAND SYSTEM



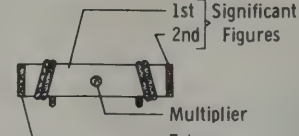
Resistors With Black Body Color Are Composition, Non-Insulated.
Resistors With Colored Bodies Are Composition, Insulated.
Wire-Wound Resistors Have The 1st Digit Color Band Double Width.

RESISTOR CODES (RESISTANCE GIVEN IN OHMS)

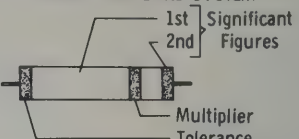
COLOR	DIGIT	MULTIPLIER	TOLERANCE
BLACK	0	1	±20%
BROWN	1	10	±1%
RED	2	100	±2%
ORANGE	3	1000	±3% *
YELLOW	4	10000	GMV*
GREEN	5	100000	±5% (RETMA Alternate)
BLUE	6	1000000	±6%*
VIOLET	7	10000000	±12 1/2%*
GRAY	8	.01 (RETMA Alternate)	±30% *
WHITE	9	.1 (RETMA Alternate)	±10% (RETMA Alternate)
GOLD		.1 (JAN and RETMA Preferred)	±5% (JAN and RETMA Pref.)
SILVER		.01 (JAN and RETMA Preferred)	±10% (JAN and RETMA Pref.)
NO COLOR			±20%

*GMV = guaranteed minimum value, or -0 - 100% tolerance.
±3, 6, 12 1/2, and 30% are ASA 40, 20, 10, and 5 step tolerances.

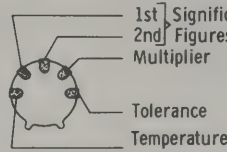
BODY-END-DOT SYSTEM



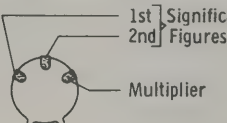
BODY-END BAND SYSTEM



DISC CERAMICS (5-DOT SYSTEM)



DISC CERAMICS (3-DOT SYSTEM)

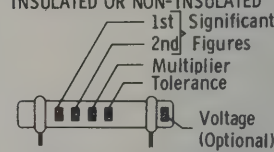


CERAMIC CAPACITOR CODES (CAPACITY GIVEN IN MMF)

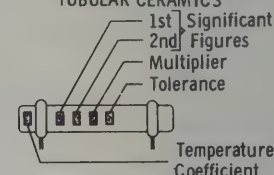
COLOR	DIGIT	MULTIPLIER	TOLERANCE		TEMPERATURE COEFFICIENT PPM/°C	EXTENDED RANGE	
			10MMF or LESS	OVER 10MMF		TEMP. COEFF.	MULTIPLIER
BLACK	0	1	±2.0MMF	±20%	0(NPO)	0.0	-1
BROWN	1	10	±0.1MMF	±1%	-33(N033)		-10
RED	2	100		±2%	-75(N075)	1.0	-100
ORANGE	3	1000		±2.5%	-150(N150)	1.5	-1000
YELLOW	4	10000			-220(N220)	2.2	-10000
GREEN	5		±0.5MMF	±5%	-330(N330)	3.3	+1
BLUE	6				-470(N470)	4.7	+10
VIOLET	7				-750(N750)	7.5	+100
GRAY	8	.01	±0.25MMF		+30(P030)		+1000
WHITE	9	.1	±1.0MMF	±10%	General Purpose Bypass & Coupling +100(P100) (Jan)		+10000
SILVER							
GOLD							

Ceramic capacitor voltage ratings are standard 500 volts, for some manufacturers, 1000 volts for other manufacturers, unless otherwise specified.

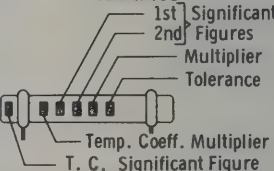
HIGH CAPACITY TUBULAR CERAMICS INSULATED OR NON-INSULATED



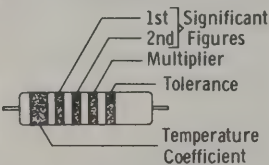
TEMPERATURE COMPENSATING TUBULAR CERAMICS



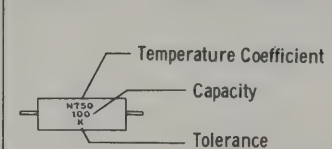
EXTENDED RANGE T.C. TUBULAR CERAMICS



MOLDED-INSULATED AXIAL LEAD CERAMICS

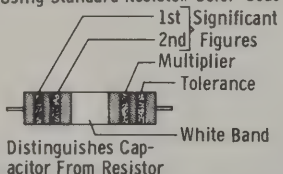


TYPOGRAPHICALLY MARKED CERAMICS

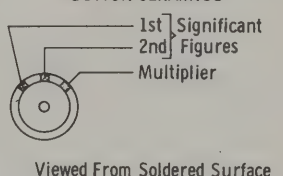


JAN LETTER	TOLERANCE	
	10MMF or LESS	OVER 10MMF
C	±0.25MMF	
D	±0.5MMF	
F	±1.0MMF	±1%
G	±2.0MMF	±2%
J		±5%
K		±10%
M		±20%

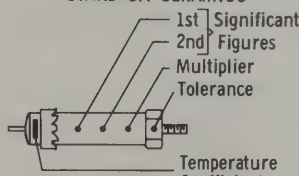
MOLDED CERAMICS Using Standard Resistor Color-Code



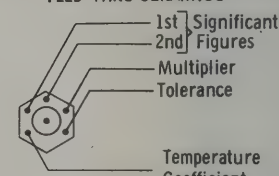
BUTTON CERAMICS



STAND-OFF CERAMICS



FEED-THRU CERAMICS



MOLDED MICA CAPACITOR CODES (Capacity Given In MMF)

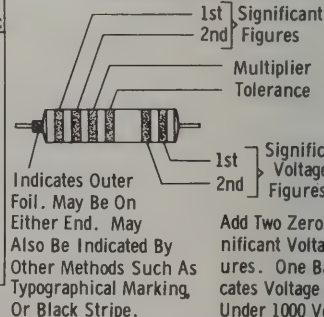
COLOR	DIGIT	MULTIPLIER	TOLERANCE	CLASS OR CHARACTERISTIC
BLACK	0	1	20%	A
BROWN	1	10	1%	B
RED	2	100	2%	C
ORANGE	3	1000	3%	D
YELLOW	4	10000		E
GREEN	5		5%(RETMA)	F(JAN)
BLUE	6			G(JAN)
VIOLET	7			
GRAY	8			I(RETMA)
WHITE	9			J(RETMA)
GOLD		.1	5%(JAN)	
SILVER		.01	10%	

Class or characteristic denotes specifications of design involving Q factors, temperature coefficients, and production test requirements.
All axial lead mica capacitors have a voltage rating of 300, 500, or 1000 volts.
*or ±1.0 MMF whichever is greater.

MOLDED PAPER CAPACITOR CODES (Capacity Given In MMF)

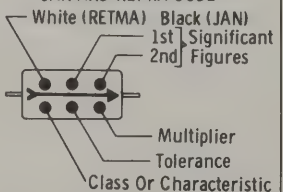
COLOR	DIGIT	MULTIPLIER	TOLERANCE
BLACK	0	1	20%
BROWN	1	10	
RED	2	100	
ORANGE	3	1000	
YELLOW	4	10000	
GREEN	5	100000	5%
BLUE	6	1000000	
VIOLET	7		
GRAY	8		
WHITE	9		10%
GOLD			5%
SILVER			10%
NO COLOR			20%

MOLDED PAPER TUBULAR

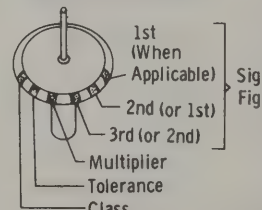


Add Two Zeros To Significant Voltage Figures. One Band Indicates Voltage Ratings Under 1000 Volts.

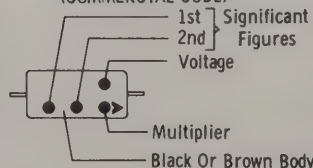
CURRENT STANDARD JAN AND RETMA CODE



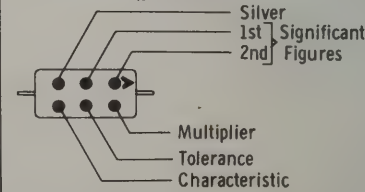
BUTTON SILVER MICA

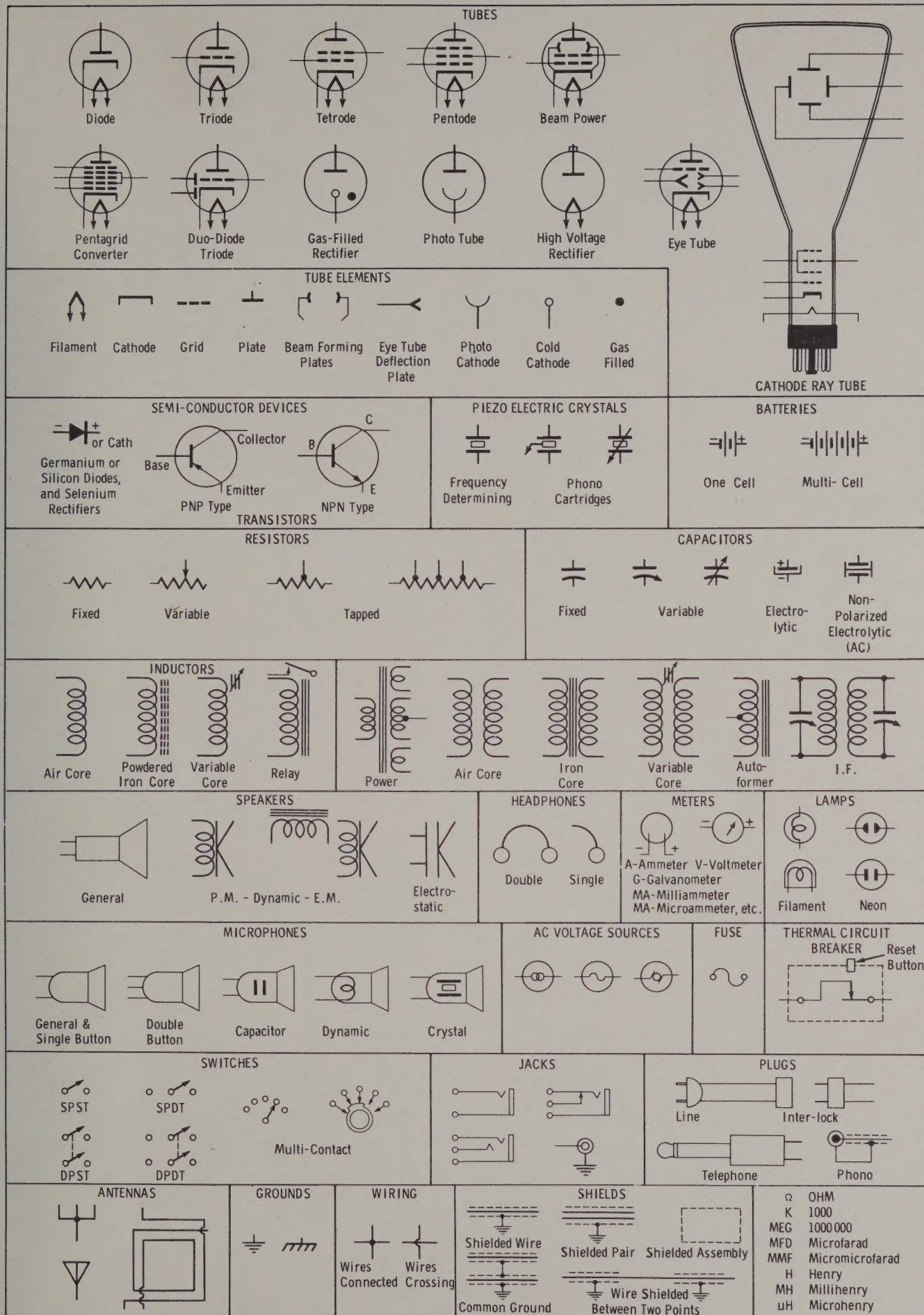


MOLDED FLAT PAPER CAPACITORS (COMMERCIAL CODE)



MOLDED FLAT PAPER CAPACITORS (JAN CODE)





The first line of test instrument kits engineered and produced
under the auspices of a major test equipment manufacturer

**The Finest
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